CLAIMS

What is claimed is:

1. An apparatus, comprising:

a lower mirror and an output coupler defining a laser cavity;

a gain region in a monolithic gain structure positioned in the laser cavity; and

an absorber integrated with the gain region in the monolithic gain structure, wherein a saturation fluence of the absorber is less than a saturation fluence of the gain region.

2. The apparatus of claim 1 wherein the apparatus is a vertical cavity surface emitting laser (VCSEL).

3. The apparatus of claim 1 wherein the apparatus is a vertical external cavity surface emitting laser (VECSEL).

4. The apparatus of claim 1 wherein the absorber is aligned with a peak field intensity of a standing wave pattern generated during excitation of the gain region.

5. The apparatus of claim 1, further comprising an intermediate mirror positioned in the monolithic gain structure, the intermediate mirror to align a peak field intensity

of a standing wave pattern generated during excitation of the gain region with the absorber.

6. The apparatus of claim 1 wherein the absorber comprises a quantum dot layer and the gain region comprises a quantum well layer.

7. The apparatus of claim 1 wherein the absorber comprises a first quantum well layer and the gain region comprises a second quantum well layer.

8. The apparatus of claim 7 wherein the first quantum well layer comprises Gallium Indium Nitride Arsenide (GaInNAs) and the second quantum well layer comprises Indium Gallium Arsenide (InGaAs).

9. The apparatus of claim 1, further comprising a plurality of electrical contacts electrically coupled to the absorber to receive an electrical signal to adjust the saturation fluence of the absorber.

10. The apparatus of claim 1 wherein the monolithic gain structure comprises the lower mirror.

11. The apparatus of claim 10 wherein the monolithic gain structure comprises the output coupler.

12. The apparatus of claim 1, further comprising a nonlinear crystal optically coupled to the output coupler to change a wavelength of a laser output emitted from the output coupler.

13. The apparatus of claim 1, further comprising a thermal lens within the laser cavity.

14. The apparatus of claim 1, further comprising a heat sink thermally coupled to the lower mirror.

15. The apparatus of claim 1, further comprising a second output coupler positioned proximate to the lower mirror to define a second laser cavity, the absorber and the gain region within the second laser cavity, wherein the first laser cavity defines a first SEL and the second laser cavity defines a second SEL.

16. The apparatus of claim 15 wherein the first SEL and the second SEL are independently addressable.

17. A vertical cavity surface emitting laser (VCSEL), comprising:

a gain region positioned proximate to a lower mirror;

an absorber positioned proximate to the gain region, wherein a saturation fluence of the absorber is less than a saturation fluence of the gain region; and

a spacer positioned proximate to the absorber, the spacer including a microlens,

wherein the lower mirror, the gain region, the absorber, and the spacer are a monolithic structure fabricated from a substrate.

18. The VCSEL of claim 17 wherein the absorber comprises at least one quantum dot layer and the gain region comprises at least one quantum well layer.

19. The VCSEL of claim 17 wherein the absorber comprises at least one quantum well layer of Gallium Indium Nitride Arsenide (GaInNAs).

20. The VCSEL of claim 17 wherein the absorber is aligned with a peak field intensity of a standing wave pattern generated during excitation of the gain region.

21. The VCSEL of claim 17, further comprising a first contact coupled to the lower mirror and a second contact coupled to the spacer, the first and second contacts to be used in electrical pumping of the VCSEL.

22. A system, comprising:

a surface emitting laser (SEL) array, comprising:

a first output coupler and a lower mirror defining a first laser cavity of a first SEL;

a second output coupler and the lower mirror defining a second laser cavity of a second SEL;

a gain region positioned in the first and second laser cavities; and

an absorber positioned in the first and second laser cavities integrated with the gain region, wherein a saturation fluence of the absorber is less than a saturation fluence of the gain region; and

an optical fiber optically coupled to the SEL array to receive a first passively mode locked laser output from the first output coupler and to receive a second passively mode locked laser output from the second output coupler.

23. The system of claim 22 wherein the lower mirror, the gain region, the absorber, the first output coupler, and the second output coupler are a monolithic structure fabricated from a substrate.

24. The system of claim 22 wherein the first SEL and the second SEL are independently addressable.

25. A computer system, comprising:

a chipset; and

a clock operatively coupled to the chipset, the clock comprising:

a lower mirror and an output coupler defining a laser cavity, the output coupler to emit a passively mode-locked laser output for generating a clock signal;

a gain region in a monolithic gain structure positioned in the laser cavity; and

an absorber in the monolithic gain structure, wherein a saturation fluence of the absorber is less than a saturation fluence of the gain region.

26. The computer system of claim 25 wherein the monolithic gain structure comprises the lower mirror, the gain region, the absorber, and the output coupler.

27. The computer system of claim 25 wherein the clock to output an optical clocking signal.

28. An apparatus, comprising:

a quantum dot semiconductor saturable absorber mirror;

an output coupler, the quantum dot saturable mirror and the output coupler defining a laser cavity; and

a laser medium positioned within the laser cavity.

29. The apparatus of claim 28 wherein the quantum dot semiconductor saturable absorber mirror is integrated with the laser medium.

30. The apparatus of claim 29 wherein the output coupler is a curved reflector integrated with the laser medium.